Berry Lake, Oconto County Wisconsin Fisheries Survey Report, 2003

Waterbody Identification Code 418300

Image courtesy of the United States Geological Survey.

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February 2006

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SUMMARY

Wisconsin Department of Natural Resources personnel conducted a fisheries survey of Berry Lake, Oconto County during the 2003 field season. Bluegill was the most abundant species sampled, and pumpkinseed, largemouth bass, bluntnose minnow, and black crappie were common. Brown bullhead, golden shiner, Iowa darter, mimic shiner, northern pike, rock bass, walleye, yellow bullhead, and yellow perch were sampled in low numbers (less than 15). Berry Lake's fish community was diverse, but dominated by bluegill, pumpkinseed, and largemouth bass. The size structure of the bluegill and pumpkinseed populations was poor; a problem documented from the earliest surveys of the lake. The condition (weight at a given length) of the black crappie, bluegill, and largemouth bass populations was suboptimal. All species sampled were considered to be self-sustaining; Berry Lake has not been stocked since 1995.

Lake and location
Berry Lake, Oconto County, T28N R17E Sec 19

Physical / chemical attributes (Carlson, Andrews, and Threinen 1977)
Surface acres: 201
Maximum depth 27 feet
Lake type: seepage
Watershed: 2.6 square miles, including 32 acres of adjoining wetlands
Basic water chemistry: hard water that is slightly acid and of high transparency, pH = 6.9, conductance at 77 ˚F = 156
Littoral substrate: 70 percent sand and 30 percent muck
Aquatic vegetation: diverse with no known exotic species
Other features: Waterfowl make limited use of this lake. Public access with limited parking is available from a town of Underhill landing.

Purpose of surveys
Assess the nearshore summer fish community, especially panfish, and assess the nearshore fall gamefish community.

Dates of fieldwork
Mini-fyke netting August 14, 2003, electrofishing October 7, 2003

BACKGROUND

Berry Lake is a hard water seepage lake of 201 acres, a maximum depth of 27 feet, and a mean depth of 8 feet. Berry Lake has no outlet, and water levels tend to fluctuate up to four feet (Langhurst 1988). Berry Lake was classified as mesotrophic by Cleereman (1994) based on phosphorus concentration, chlorophyll a concentration, and Secchi depth. The water quality data collected on 13 August 2003 by Greg Sevener, Wisconsin Department of Natural Resources (WI DNR; Table 1), agreed with the findings of Cleereman (1994) and Carlson et al. (1977). Berry Lake contains a diverse aquatic plant population and no known exotic plant or invertebrate species (Richard Sachs, WI DNR, personal communication). Human development of Berry Lake's shoreline is high, which results in increased levels of anthropogenic inputs to the lake and a significant erosion potential (Cleereman 1994). Berry Lake also has the potential for winter fish kills, based on winter dissolved oxygen levels measured by Cleereman (1994). Nutrient inputs due to human activities in the watershed increase the possibility of fish kills, but there are no known major land use problems in the watershed (Greg Kornely, WI DNR, personal communication). A fish kill was reported and investigated by WI DNR personnel during June of 1995 (only panfish species found).

The Town of Underhill owns and maintains a boat landing that is open to the public. The landing is adequate under most conditions, but can be difficult to utilize when lake levels are low (Greg Kornely and Rod Lange, WI DNR, personal communication).

Berry Lake has been stocked sporadically since 1937 with a variety of fish species (Table 2). Five fisheries surveys and two limnological assessments have been conducted on Berry Lake since 1949 (Table 3). These surveys showed Berry Lake's fish community to be composed primarily of black crappie *Pomoxis nigromaculatus*, bluegill *Lepomis macrochirus*, brown bullhead *Ameiurus nebulosus*, largemouth bass *Micropterus salmoides*, northern pike *Esox lucius*, pumpkinseed *Lepomis gibbosus*, yellow bullhead *Ameiurus natalis*, and yellow perch *Perca flavescens*. Other species sampled have included bluntnose minnow *Pimephales notatus*, golden shiner *Notemigonius crysoleucas*, green sunfish *L. cyanellus*, Iowa darter *Etheostoma exile*, mimic shiner *Notropis volucellus*, rock bass *Ambloplites rupestris*, walleye *Sander vitreus*, and white

sucker *Catostomus commersonii*. The high numbers of northern pike and yellow perch sampled in some surveys was likely a result of stocking efforts. Under natural conditions, northern pike and yellow perch appear to be secondary species in Berry Lake. The purpose of this report is to summarize the fisheries data collected during 2003 and compare results to previous survey reports.

METHODS

Data collection

Six mini-fyke nets (0.25-inch stretch mesh with turtle exclusion) were set on 13 August, 2003 and lifted on 14 August (Figure 1). A WI DNR standard direct current electrofishing boat was used to sample the entire shoreline (3.19 miles) on 7 October, 2003 (Figure 1). Most fish were measured (0.1 inch) for total length, and a sub-sample of fish captured during the electrofishing survey were weighed (g). The first 30 fish of each species captured in each net during the mini-fyke net survey were measured, and the remaining fish were counted. Scales were removed from five black crappies, 13 bluegills, and 13 largemouth bass to estimate individual fish ages. Ages were determined according to standard WI DNR procedures.

Data analysis

Total catch, catch per gear type, catch per mini-fyke net night, and catch per mile of shoreline electrofished were calculated for all species. I examined size structure from the black crappie, bluegill, largemouth bass, northern pike, and pumpkinseed sampled, and analyzed the weight-length data from the black crappie, bluegill, largemouth bass, and pumpkinseed sampled.

Length-frequency

All measured black crappie, bluegill, and pumpkinseed were assigned to a 0.5-inch length-class, and measured largemouth bass and northern pike were assigned to a 1.0-inch length-class. The number of fish captured in both gears was plotted against their respective length-classes for each of the four species.

Proportional stock density

I calculated proportional stock densities (PSD; Anderson and Neumann 1996) for black crappie, bluegill, largemouth bass, and pumpkinseed as:

$$PSD = \frac{number \geq quality}{number \geq stock} * 100$$

Where *PSD* is the proportional stock density, and the species specific *quality* and *stock* length minimums proposed by Gabelhouse (1984) are inserted. I calculated exact binomial 95% confidence intervals (CIs) for each PSD estimate (Zar 1999). Finally, I plotted the PSD estimates and 95% CIs for two predator-prey combinations: largemouth bass-bluegill, and largemouth bass-pumpkinseed.

Weight-length relationships

I assumed that shape changed with length for black crappie, bluegill, largemouth bass, and pumpkinseed, so I quantified the allometric weight-length model for each species:

$$W_t = \alpha L_t^{\beta}$$

Where W_t is the weight at time t, L_t is length at time t, and α and β are parameters. I logarithmically transformed the weight-length data (pounds-inches) for each species, and estimated α and β via linear regression (Anderson and Neumann 1996). I then plotted the weight-length data collected during the 2003 survey for each species, the estimated curvilinear relationship from that data, and the standard range-wide weight equations proposed for each species (black crappie-Neumann and Murphy 1991; bluegill-Hillman 1982; largemouth bass-Henson 1991; pumpkinseed-Liao et al. 1995).

Relative weight

I calculated relative weight for each fish that was measured and weighed as:

$$W_r = 100 * W / [10\text{^}\{\alpha + \beta * \log_{10}(L)\}]$$

Where W_r is relative weight, W is the observed weight in pounds, L is the observed length in inches, and α and β are parameters from the standard range-wide weight equations proposed for each species. I then used linear regression to test if W_r changed linearly with L:

$$W_r = \beta L + \alpha$$

Where W_r is relative weight, L is the observed length, β is the slope of the line, and α is the y-intercept. Relative weight W_r was considered to change with length if the slope of the line was significantly different from zero ($p \leq 0.05$). Next, I calculated a mean W_r for each species and 95% CIs about the means (Milton and Arnold 1995). Finally, I plotted

the W_r means and 95% CIs for two predator-prey combinations: largemouth bass-bluegill, and largemouth bass-pumpkinseed.

RESULTS AND DISCUSSION

A total of 1,403 fish were captured during our 2003 mini-fyke net and electrofishing surveys of Berry Lake (Figure 1). Catch per gear type, catch per mini-fyke net night, and catch per mile of shoreline electrofished are shown for each species sampled in Table 4. Bluegill was the most abundant species sampled, and pumpkinseed, largemouth bass, bluntnose minnow, and black crappie were common. Brown bullhead, golden shiner, Iowa darter, mimic shiner, northern pike, rock bass, walleye, yellow bullhead, and yellow perch were sampled in low numbers (less than 15). Berry Lake's fish community was diverse, but dominated by bluegill, pumpkinseed, and largemouth bass.

Black crappie

A total of 59 black crappies were sampled from Berry Lake during 2003. The 58 black crappies captured during electrofishing averaged 5.41 inches total length (range 3.1-10.3). The data collected on Berry Lake's black crappie population suggests steady natural reproduction with consecutive year-classes (Figure 2). The PSD calculated from the sample was 42, which exceeds the PSD guideline of 40 for black crappie in the WI DNR Fish Management Handbook (3605.9).

The weight-length relationship for black crappie was defined by the equation:

$$\log_{10}(W) = -3.469 + 3.145 * \log_{10}(L)$$

Where W is weight in pounds and L is length in inches. Black crappies sampled from Berry Lake were lighter for a given length compared to black crappies described by the standard weight equation proposed by Neumann and Murphy (1991; Figure 3). Relative weight of black crappies decreased with length (Table 5; Figure 4), and the mean W_r for the sample was 93.61 (95% CI 89.90-97.33). The fact that the weight-length relationship from the sample was lower than the standard weight equation, W_r decreased with length, and W_r was below 100 indicates that the condition of black crappies in Berry Lake is suboptimal and they are not at balance with their habitat and food supply.

Bluegill

A total of 540 bluegills averaging 2.82 inches total length (range 1.0-7.7) were sampled from Berry Lake during 2003. The data collected on Berry Lake's bluegill population suggests strong natural reproduction with consecutive year-classes (Figure 5). However, few bluegills of quality size (≥ 6 inches) were sampled (Figure 5). The PSD calculated from the Berry Lake bluegill sample was 2, while the PSD range recommended for bluegill in the WI DNR Fish Management Handbook (3605.9) is 40-60. The length-frequency data (Figure 5) and the plot of PSD estimates and 95% CIs for the two predator-prey combinations (largemouth bass-bluegill, and largemouth bass-pumpkinseed; Figure 6) suggests that small bluegills are in high abundance compared to their predator, largemouth bass.

The weight-length relationship for bluegill was defined by the equation:

$$\log_{10}(W) = -3.414 + 3.268 * \log_{10}(L)$$

Where W is weight in pounds and L is length in inches. Bluegills sampled from Berry Lake were lighter for a given length compared to bluegills described by the standard weight equation proposed by Hillman (1982; Figure 7). Relative weight of bluegills did not differ significantly with length (Table 5; Figure 8), and the mean W_r for the sample was 85.29 (95% CI 83.21-87.37). The W_r of bluegills in Berry Lake is quite low, and indicates that condition is poor. The plot of W_r means and 95% CIs for two predator-prey combinations (largemouth bass-bluegill, and largemouth bass-pumpkinseed) further illustrate this point (Figure 9). Berry Lake's largemouth bass and pumpkinseeds are considered in suboptimal condition because W_r for both species is below 100, but W_r of bluegills is much lower and they are in the poorest condition of the four species examined (Table 5).

Largemouth bass

A total of 161 largemouth bass were sampled from Berry Lake during 2003. The 59 largemouth bass captured during electrofishing averaged 11.76 inches total length (range 4.6-20.5). The data collected on Berry Lake's largemouth bass population suggests steady natural reproduction with consecutive year-classes (Figures 10 and 11). However, few largemouth bass greater than or equal to 15 inches were sampled while electrofishing (6 of 59 or 10.17%; Figure 11), indicating that current fishing regulations

may not be adequate to protect largemouth bass in Berry Lake (Table 5). The PSD calculated from the Berry Lake largemouth bass sample was 56, which is within the recommended PSD range (40-70) for largemouth bass (Anderson and Neumann 1996). The length-frequency data (Figures 10 and 11) and the plot of PSD estimates and 95% CIs for the two predator-prey combinations (largemouth bass-bluegill, and largemouth bass-pumpkinseed; Figure 6) suggests that large largemouth bass are in low abundance relative to their prey sources, small bluegills and pumpkinseeds.

The weight-length relationship for largemouth bass was defined by the equation:

$$\log_{10}(W) = -3.509 + 3.161 * \log_{10}(L)$$

Where W is weight in pounds and L is length in inches. Largemouth bass sampled from Berry Lake were lighter for a given length compared to largemouth bass described by the standard weight equation proposed by Henson (1991; Figure 12). Relative weight of largemouth bass decreased with length (Table 5; Figure 13), and the mean W_r for the sample was 91.52 (95% CI 89.48-93.55). The W_r of largemouth bass in Berry Lake is less than 100, indicating poor condition. The fact that the weight-length relationship from the sample was lower than the standard weight equation, W_r decreased with length, and W_r was below 100 indicates that the condition of largemouth bass in Berry Lake is suboptimal and they are not at balance with their habitat and food supply.

Northern pike

A total of 10 northern pike averaging 16.23 inches total length (range 7.4-19.5) were sampled from Berry Lake during 2003 (Figure 14). The number and size-structure of northern pike sampled suggests that reproduction is sporadic, our gears were not effective at sampling northern pike, or a combination of the two. No further analyses could be performed due to the low sample size.

Pumpkinseed

A total of 227 pumpkinseeds averaging 2.64 inches total length (range 1.1-8.4) were sampled from Berry Lake during 2003. The data collected on Berry Lake's pumpkinseed population suggests steady natural reproduction with consecutive year-classes (Figure 15). However, the PSD calculated from the Berry Lake pumpkinseed sample was low

(18), compared to the recommended PSD range (40-60) in the WI DNR Fish Management Handbook (3605.9).

The weight-length relationship for pumpkinseed was defined by the equation:

$$\log_{10}(W) = -3.374 + 3.318 * \log_{10}(L)$$

Where W is weight in pounds and L is length in inches. Pumpkinseeds sampled from Berry Lake were slightly lighter for a given length compared to pumpkinseeds described by the standard weight equation proposed by Liao et al. (1995; Figure 16). However, the β parameter from the sample (3.318) was greater than the proposed β parameter (3.237; Liao et al. 1995). Relative weight of pumpkinseeds increased with length (Table 5; Figure 17), and the mean W_r for the sample was 93.52 (95% CI 91.31-95.72). The W_r of pumpkinseed from Berry Lake was less than 100, indicating poor condition. However, the sample's increasing W_r with length and large β parameter relative to that proposed by Liao et al. (1995) suggest that pumpkinseed are in suboptimal condition when small (young), but condition increases towards 'optimal' with length (age). The abundant small bluegills are likely competing for resources with small pumpkinseeds, resulting in poor condition for both species. Large pumpkinseeds are presumably in better condition because there are few large bluegills to compete with for food and space.

CONCLUSIONS AND RECOMMENDATIONS

In-lake habitat appears adequate as most fish species native to Berry Lake are self-sustaining. The 2003 data suggests that natural reproduction was steady for black crappie, bluegill, largemouth bass, and pumpkinseed. Northern pike were sampled in low numbers (10) and are presumably not reproducing well. Northern pike reproduction in Berry Lake is likely influenced by the fluctuating water levels. The emergent vegetation essential for successful northern pike reproduction is probably not available during years with low spring water levels. Conversely, reproduction is likely satisfactory during years with high spring water levels.

The 2003 fisheries survey of Berry Lake was not comprehensive enough to reveal needed management actions. However, 2003 survey results agree with the findings of previous surveys. The PSD was low for bluegill and pumpkinseed, which agrees with the findings of Langhurst (1988). The PSD of black crappie met the recommended

guideline, which also agrees with the findings of Langhurst (1988). The weight-length relationship and W_r for black crappie, bluegill, and largemouth bass indicated poor condition. Although W_r is not always an accurate predictor of growth (Anderson and Neumann 1996), the poor condition of black crappies, bluegills, and largemouth bass observed in the 2003 sample is consistent with growth results from previous surveys. Burdick (1950) characterized Berry Lake's black crappie and bluegill populations as very slow growing, and recommended investigating the possibility of reducing panfish numbers via partial chemical eradication. Similarly, Langhurst (1988) concluded that growth of black crappie and largemouth bass was slow, and growth of bluegills and pumpkinseeds was poor. Langhurst (1988) recommended that a high predator population be maintained to 'control' bluegills.

Stocking predators, especially northern pike, was the management action of choice during the past 65 years. I do not recommend continued stocking of predators to 'control' panfish species, because extensive efforts of the past failed to yield the desired results. Predator densities (especially northern pike) remain relatively low, indicating inadequate natural reproduction or excessive harvest. Small bluegills were abundant and slow growing in 1985 (Langhurst 1988), even after years of substantial predator stocking, and bluegills remained abundant, exhibited an undesirable population size structure, and were in poor condition in 2003.

Protecting largemouth bass such that large fish are more abundant may be more effective at reducing small bluegill abundance than stocking predators. However, the population dynamics of largemouth bass must be better understood before more restrictive regulations are proposed. A fisheries survey should be conducted to collect length, weight, and age data on largemouth bass such that growth and mortality can be quantified. If good growth rates but high mortality rates are observed, then it can be inferred that angler harvest may be limiting the number of large largemouth bass in the population. More restrictive fishing regulations could then be proposed to protect largemouth bass to larger sizes. This in turn, would increase the level of predation on bluegills and possibly result in a more desirable size structure.

ACKNOWLEDGMENTS

Alan Niebur, Rodney Lange, and Daniel Schroeder collected the data summarized in this report. Greg Kornely and many other WI DNR personnel collected and summarized data from past surveys. George Boronow, Mike Donofrio, Andrew Fayram, Greg Kornely, and Lee Meyers provided comments on drafts of this report. The title page image was courtesy of terraserver.microsoft.com and the United States Geological Survey.

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Table 1. Water quality data collected from Berry Lake, Oconto County Wisconsin on 13 August 2003.

Test	Result	Units
Total alkalinity	55	mg/l
Conductivity at 25 C	138	umhos/cm
pH (lab)	8.3	su
Total recoverable magnesium	7.2	mg/l
Total Kjeldahl nitrogen	0.88	mg/l
Total phosphorus	0.012	mg/l
Cloud cover	5	%
Conductivity (field)	139	mg/l
Dissolved oxygen	10.2	mg/l
pH (field)	8.6	su
Secchi depth	9.5	feet
Temperature	24.2	C
Total recoverable calcium	13	mg/l
Chlorophyll a	4.48	ug/l

Table 2. Year, species, number stocked, size-class at time of stocking, and notes from Berry Lake, Oconto County Wisconsin stocking events, 1937-1995.

Year	Species	Number stocked	Size-class	Notes
1937	Yellow perch	3,700	Fingerling	-
1937	Bluegill	3,700	Fingerling	-
1937	Smallmouth bass	87	Adult	-
1938	Largemouth bass	10,000	Fry	-
1939	Bluegill	2,000	Adult	-
	Bluegill	300	Fingerling	-
	Largemouth bass	800	Fingerling	-
	Northern pike	500	Fingerling	-
	Yellow perch	100	Adult	-
	Yellow perch	27,000	Fingerling	-
1940	Largemouth bass	1,000	Fingerling	-
	Northern pike	15,000	Fry	-
1941	Northern pike	45,000	Fry	-
1942	Northern pike	34,000	Fry	-
1943	Largemouth bass	3,000	Fingerling	-
	Northern pike	30,000	Fry	-
1944	Northern pike	30,000	Fry	-
1947	Largemouth bass	3,000	Fingerling	-
1948	Northern pike	55,000	Fry	-
1951	Northern pike	150	Adult	-
1952	Northern pike	68	Adult	-
1953	Northern pike	68	Adult	-
1954	Northern pike	65	-	-
1972	Northern pike	300	Adult	Transfers from Rush Lake, left maxillary clip
1974	Northern pike	300	Adult	Transfers from Rush Lake
1975	Northern pike	1,200	Adult	Transfers from Rush Lake
1976	Northern pike	300	Adult	Transfers from Rush Lake
1985	Walleye	2,000	3-4 inch fingerling	Lake association stocking
1986	Walleye	2,000	3-4 inch fingerling	Underhill Sportsman Club stocking
1991	Northern pike	680	Fingerling	Wild Rose Hatchery
1992	Walleye	1,000	7 inch fingerling	Private hatchery
1995	Walleye	640	Yearling	Private hatchery

Table 3. Year, survey type, gears used, and report status for surveys of Berry Lake, Oconto County Wisconsin, 1949-2003.

Year	Survey type	Gears used	Report
1949	fisheries	fyke nets	Burdick 1950
1972	fisheries	seine	no
1985	fisheries	fyke nets and boomshocker	Langhurst 1988
1993	limnological	various	Cleereman 1994
1994	fisheries	boomshocker	no
2003	fisheries	mini-fyke nets and boomshocker	Kapuscinski 2006

Table 4. Species, total catch in six mini-fyke nets, catch per mini-fyke net night, total catch while electrofishing, and catch per mile of shoreline electrofished during 2003. Mini-fyke nets were set on 13 August and lifted on 14 August. The entire shoreline of Berry Lake was electrofished on 7 October. The largemouth bass and northern pike data collected while electrofishing the entire shoreline during 3 June and 10 September 1994 is also provided.

	Mini-fyke net		Electrofishing		Electrofishing 3 June 1994		Electrofishing 10 Sept 1994	
Species	Total catch	Catch per net night	Total catch	Catch per mile	Total catch	Catch per mile	Total catch	Catch per mile
Black crappie	1	0.17	58	18.18	-	-	-	-
Bluegill	338	56.33	356	111.60	-	-	-	-
Bluntnose minnow	70	11.67	-	-	-	-	-	-
Brown bullhead	-	-	12	3.76	-	-	-	-
Golden shiner	-	-	6	1.88	-	-	-	-
Iowa darter	-	-	1	0.31	-	-	-	-
Largemouth bass	112	18.67	59	18.50	70	21.94	47	14.73
Mimic shiner	-	-	1	0.31	-	-	-	-
Northern pike	-	-	10	3.13	-	-	33	10.34
Pumpkinseed	309	51.50	44	13.79	-	-	-	-
Rock bass	2	0.33	5	1.57	-	-	-	-
Walleye	-	-	2	0.63	-	-	-	-
Yellow bullhead	-	-	3	0.94	-	-	-	-
Yellow perch	2	0.33	12	3.76	-	-	-	-

Table 5. Mean relative weight W_r of four species sampled from Berry Lake, Oconto County Wisconsin during 2003. The upper and lower 95% confidence limits about the mean are given (U_{cl}, L_{cl}). The F-ratio, degrees of freedom (df), and level of significance (P) from linear regression of relative weight W_r versus total length are also provided.

Species	Mean W_r	L_{cl}	U_{cl}	F-ratio	df	P
Black crappie	93.61	89.90	97.33	20.8219	1,56	0.00003
Bluegill	85.29	83.21	87.37	0.7733	1,73	0.38208
Largemouth bass	91.52	89.48	93.55	8.3653	1,57	0.00541
Pumpkinseed	93.52	91.31	95.72	5.4958	1,39	0.02425

Table 6. Fishing regulations for species sampled from Berry Lake, Oconto County Wisconsin during 2003.

Species	Open season	Daily limit	Minimum length
Largemouth bass	first Saturday in May - first Sunday in March	5	14 inches
Northern pike	first Saturday in May - first Sunday in March	5	none
Panfish: bluegill, crappie, pumpkinseed, sunfish, and yellow perch	open all year	25 in total	none
Rock bass	open all year	none	none
Walleye	first Saturday in May - first Sunday in March	5	15 inches

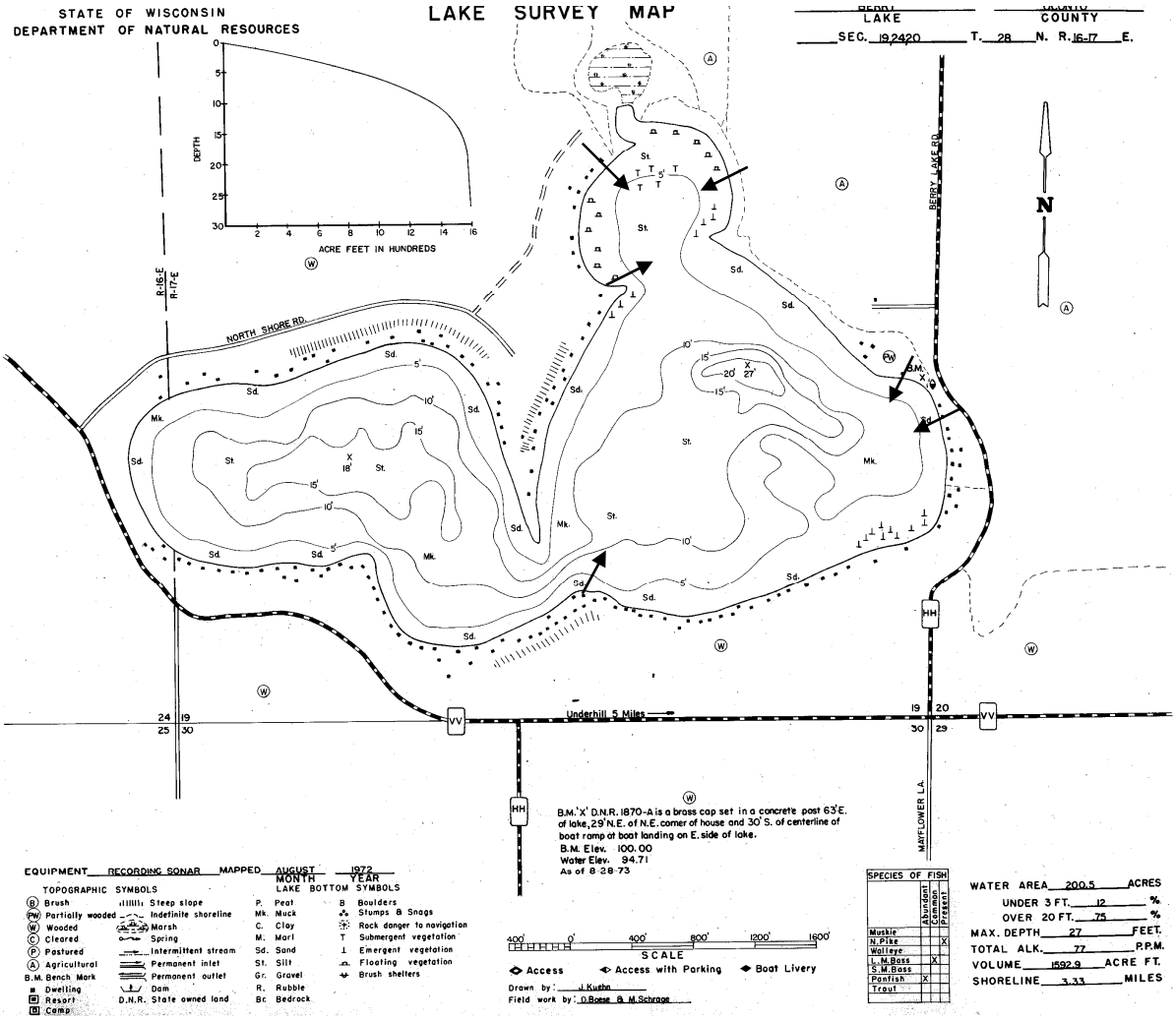

Figure 1. Contour map of Berry Lake, Oconto County Wisconsin. The black arrows indicate mini-fyke net locations surveyed during 2003.

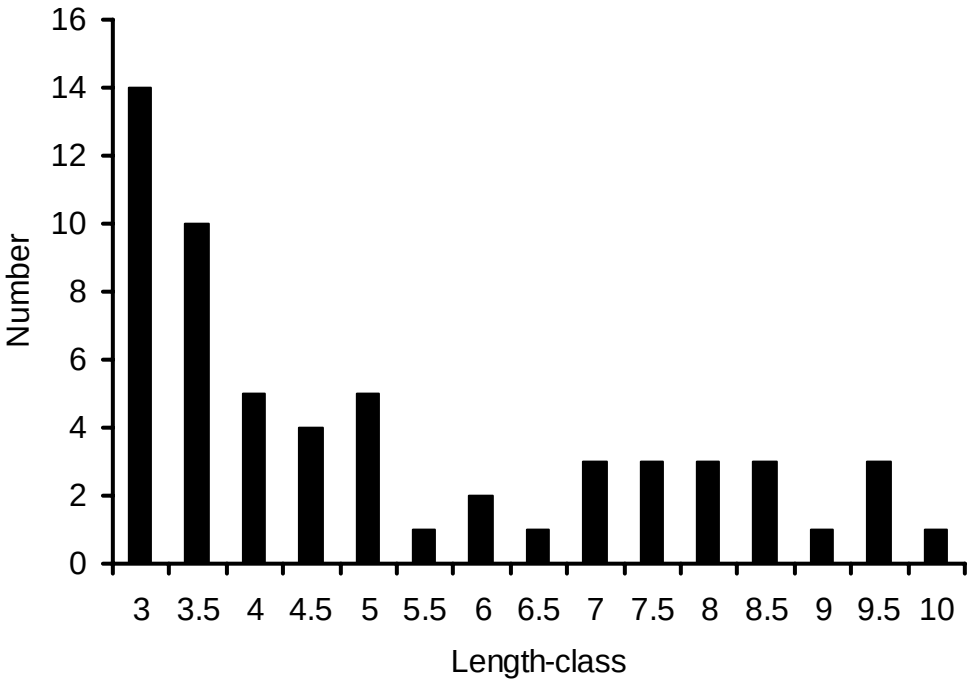

Figure 2. Number of black crappie sampled per 0.5-inch length-class from Berry Lake, Oconto County Wisconsin during 2003. Six mini-fyke nets were set on 13 August and lifted on 14 August, and the entire shoreline was electrofished on 7 October.

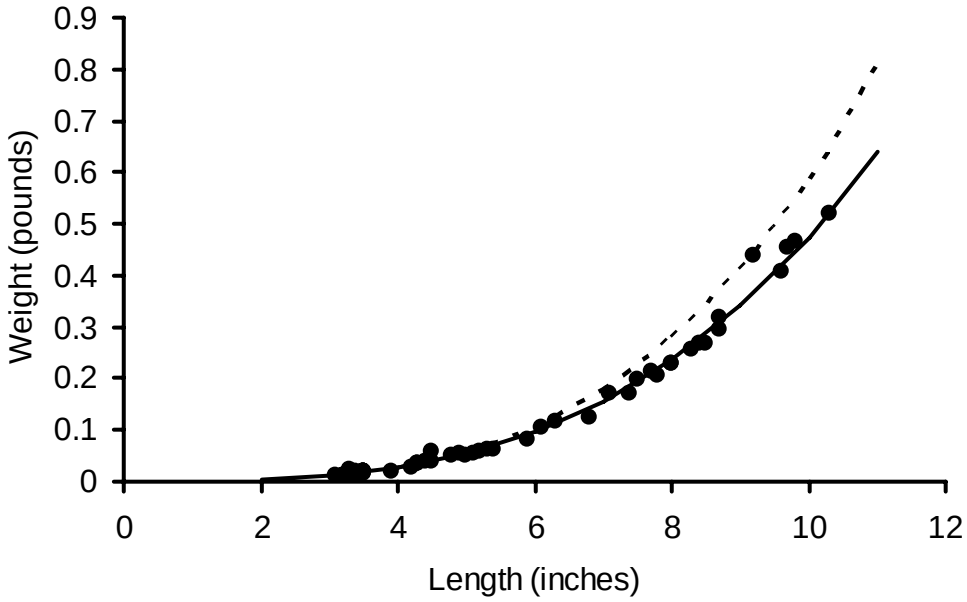

Figure 3. Weight-length data from black crappie sampled from Berry Lake, Oconto County Wisconsin during 2003. The curvilinear relationship for the sample (solid line) and the relationship proposed by Neumann and Murphy (dashed line; 1991) for the species are given.

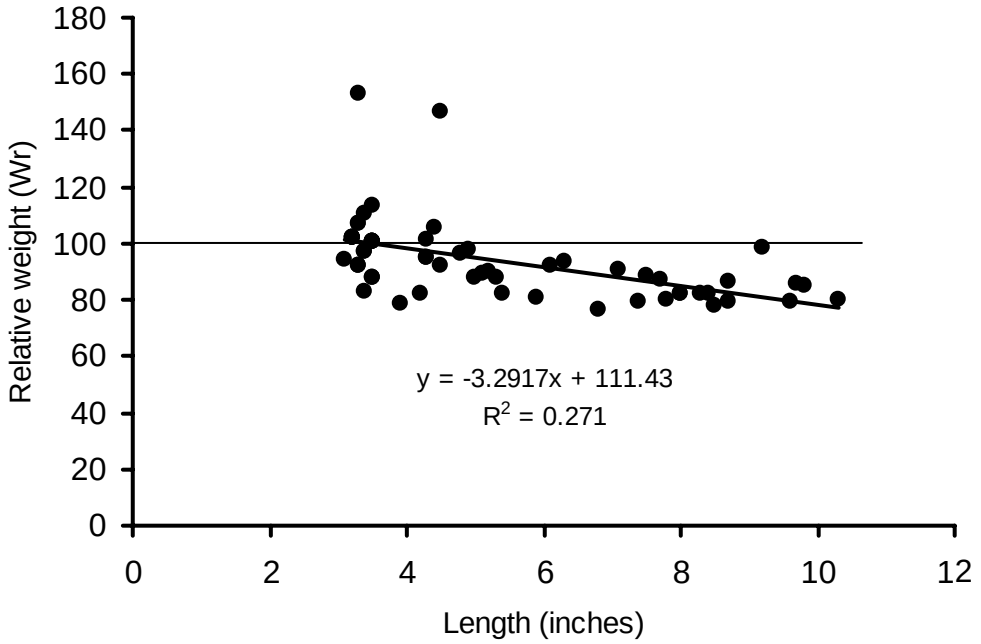

Figure 4. Relative weight W_r plotted versus length for black crappie sampled from Berry Lake, Oconto County Wisconsin during 2003. The regression line and equation, coefficient of determination R^2, and a reference line at $W_r = 100$ are given.

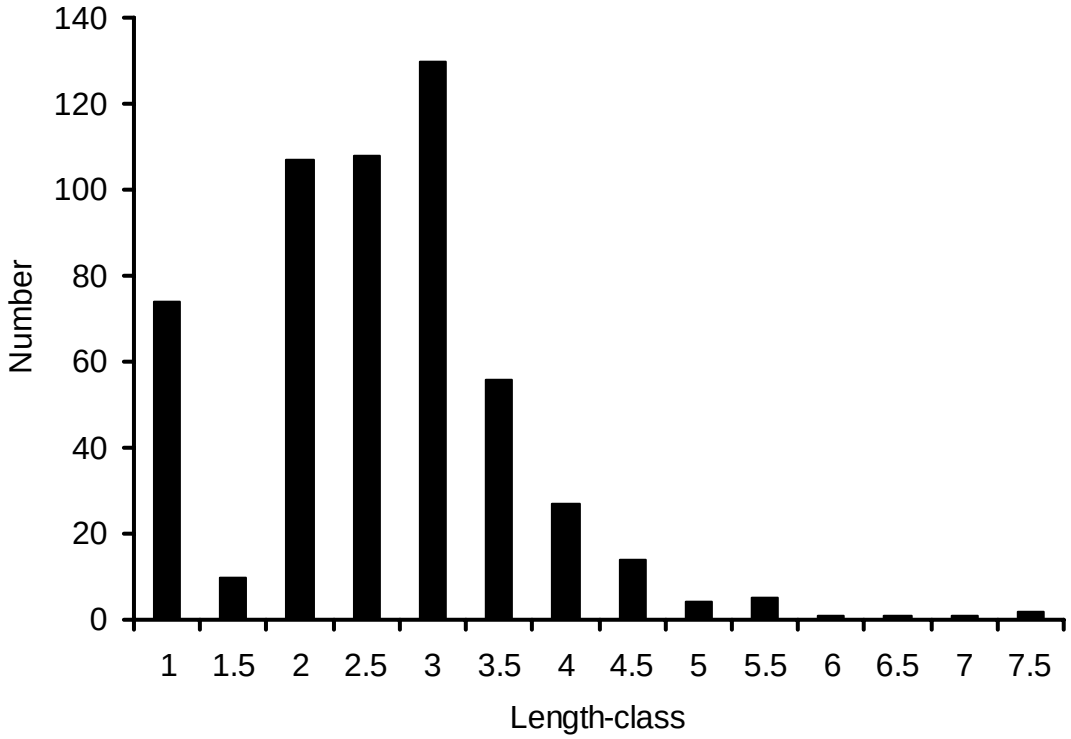

Figure 5. Number of bluegill sampled per 0.5-inch length-class from Berry Lake, Oconto County Wisconsin during 2003. Six mini-fyke nets were set on 13 August and lifted on 14 August, and the entire shoreline was electrofished on 7 October.

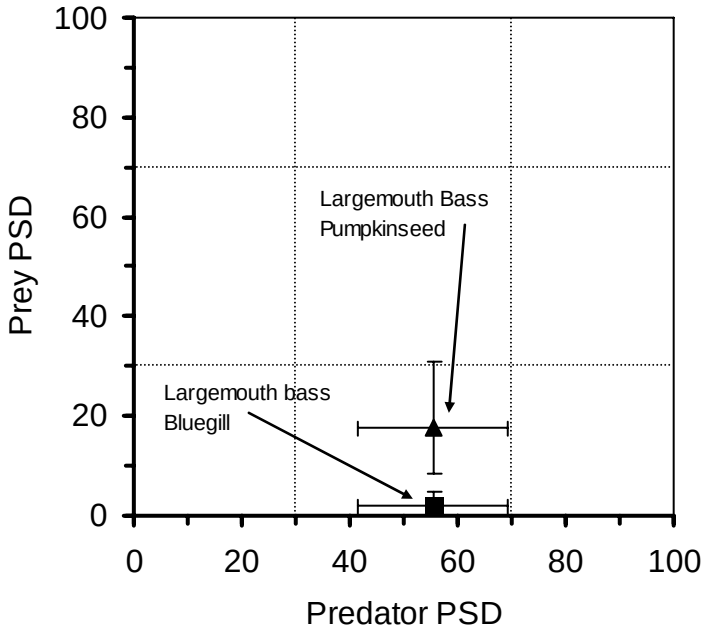

Figure 6. Prey proportional stock density *PSD* plotted against predator *PSD* for two predator-prey combinations: largemouth bass-bluegill and largemouth bass-pumpkinseed. Exact binomial 95% confidence limits of each *PSD* estimate are given.

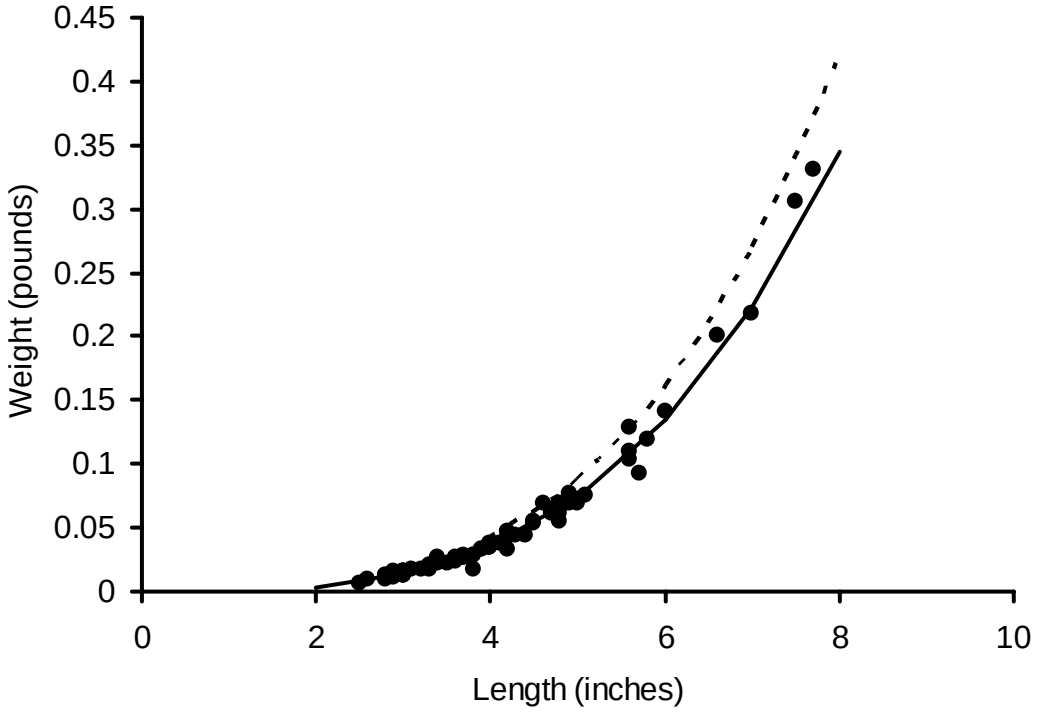

Figure 7. Weight-length data from bluegill sampled from Berry Lake, Oconto County Wisconsin during 2003. The curvilinear relationship for the sample (solid line) and the relationship proposed by Hillman (dashed line; 1982) for the species are given.

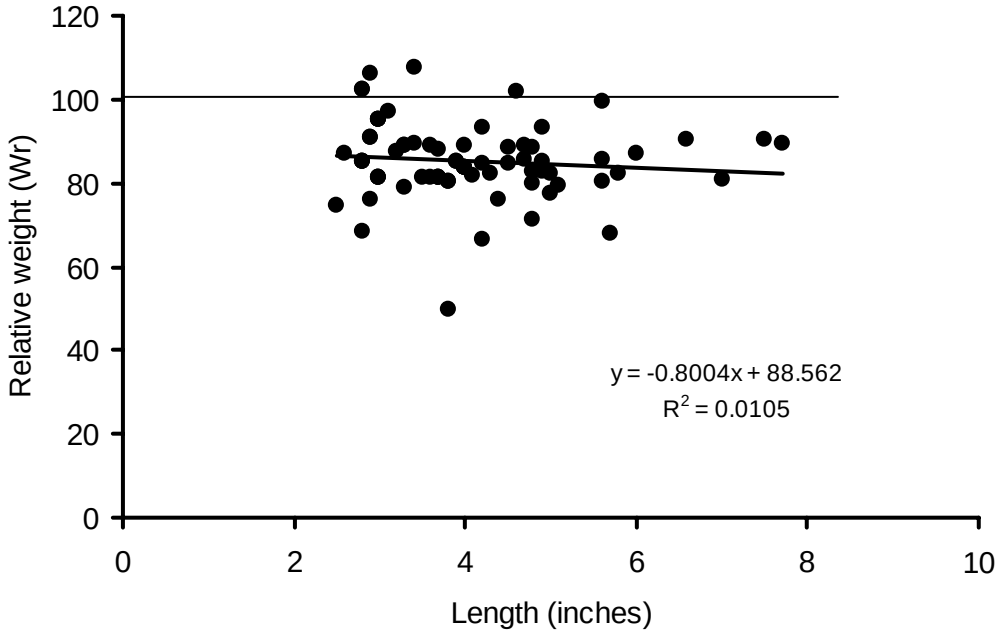

Figure 8. Relative weight W_r plotted versus length for bluegill sampled from Berry Lake, Oconto County Wisconsin during 2003. The regression line and equation, coefficient of determination R^2, and a reference line at $W_r = 100$ are given.

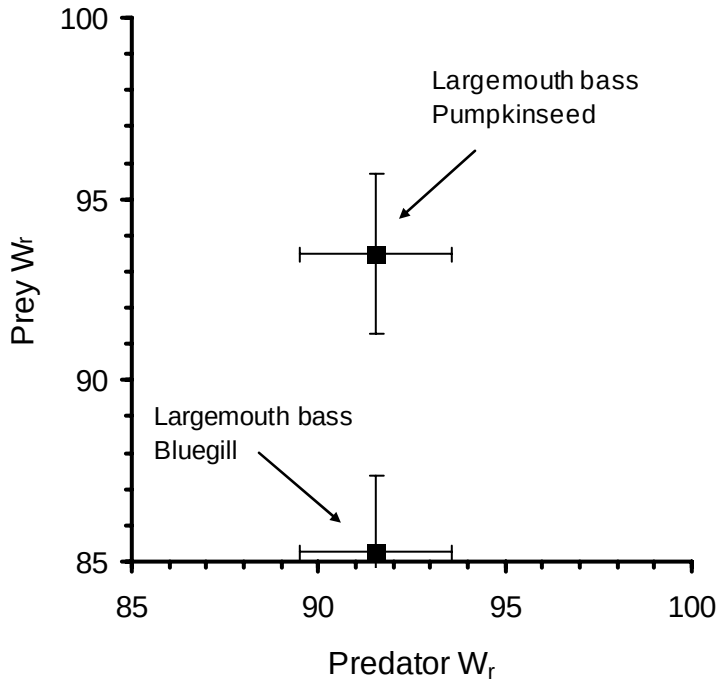

Figure 9. Mean prey relative weight W_r plotted against mean predator W_r for two predator-prey combinations: largemouth bass-bluegill and largemouth bass-pumpkinseed. Mean W_r was calculated for each species from samples collected during mini-fyke netting and electrofishing Berry Lake, Oconto County Wisconsin during 2003.

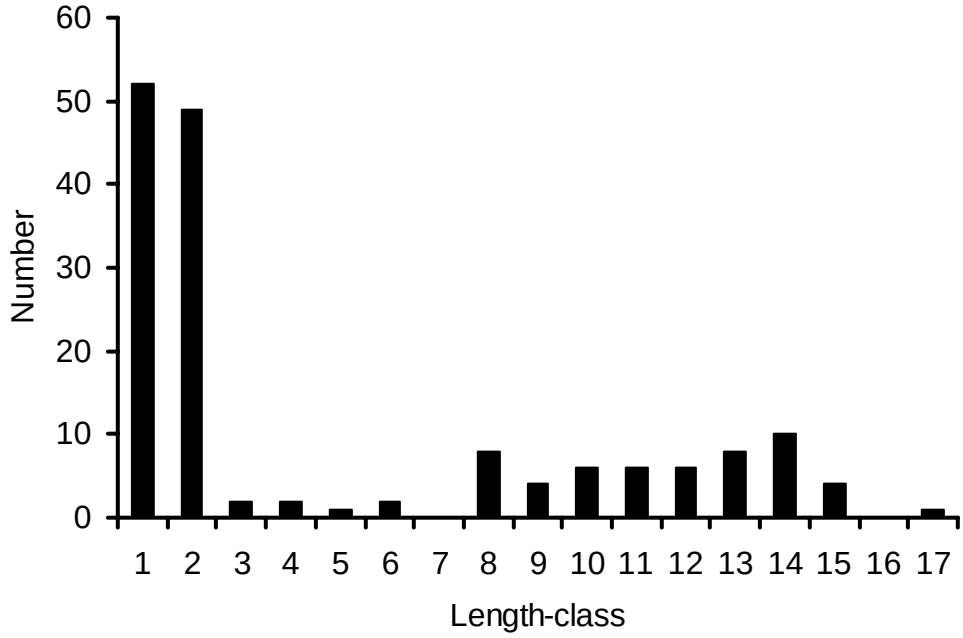

Figure 10. Number of largemouth bass sampled per 1.0-inch length-class from Berry Lake, Oconto County Wisconsin during 2003. Six mini-fyke nets were set on 13 August and lifted on 14 August, and the entire shoreline was electrofished on 7 October.

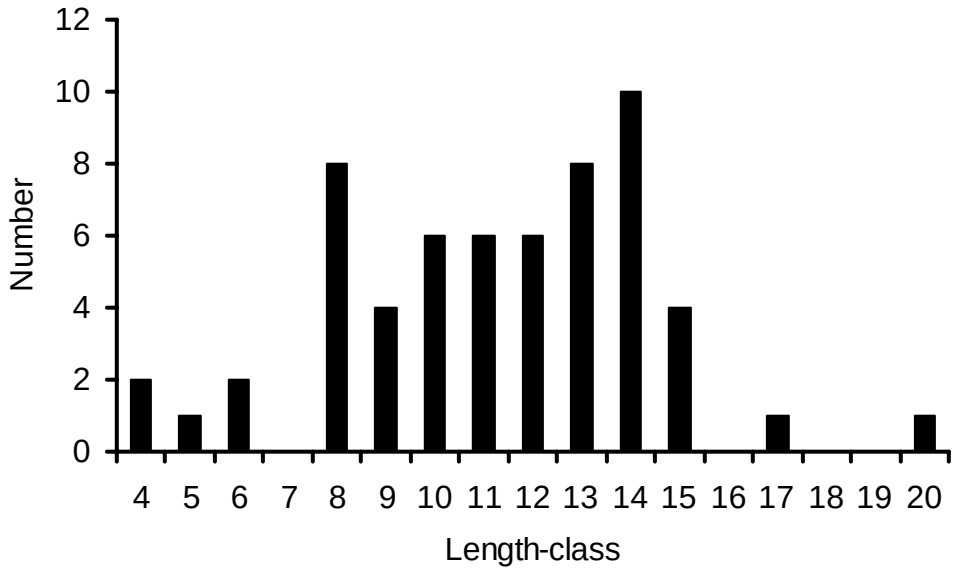

Figure 11. Number of largemouth bass sampled per 1.0-inch length-class from Berry Lake, Oconto County Wisconsin while electrofishing on 7 October 2003.

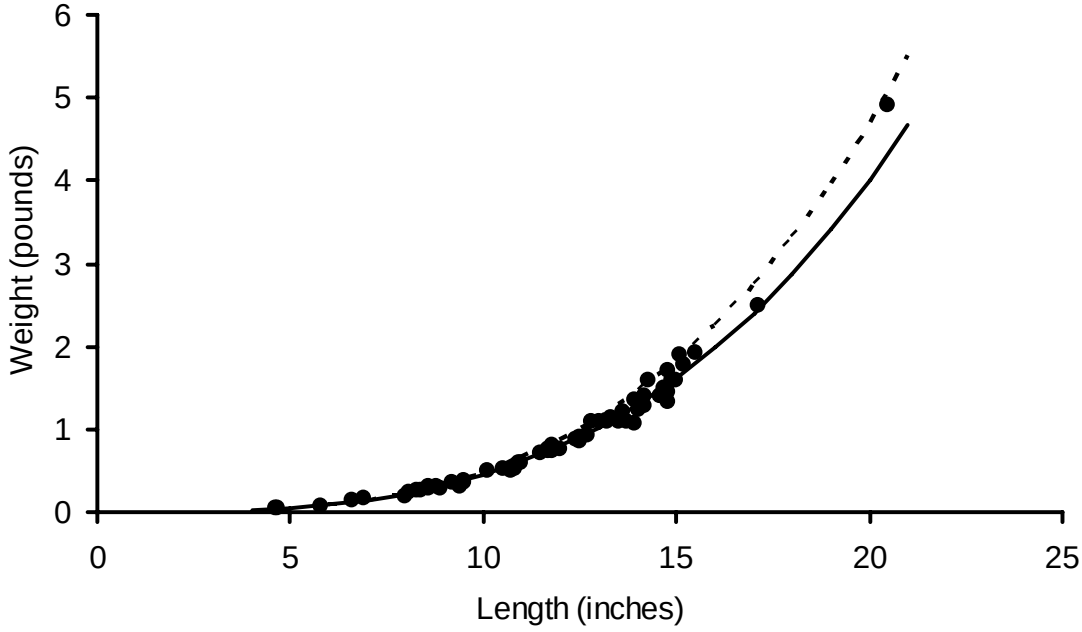

Figure 12. Weight-length data from largemouth bass sampled from Berry Lake, Oconto County Wisconsin during 2003. The curvilinear relationship for the sample (solid line) and the relationship proposed by Henson (dashed line; 1991) for the species are given.

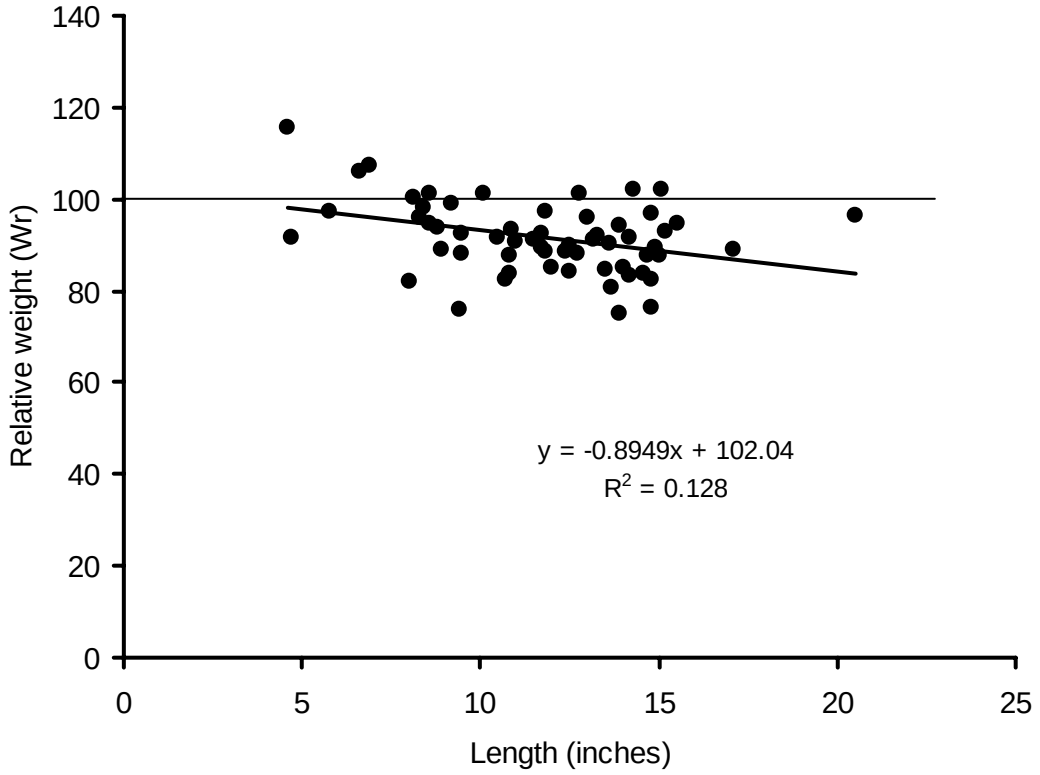

Figure 13. Relative weight W_r plotted versus length for largemouth bass sampled from Berry Lake, Oconto County Wisconsin during 2003. The regression line and equation, coefficient of determination R^2, and a reference line at $W_r = 100$ are given.

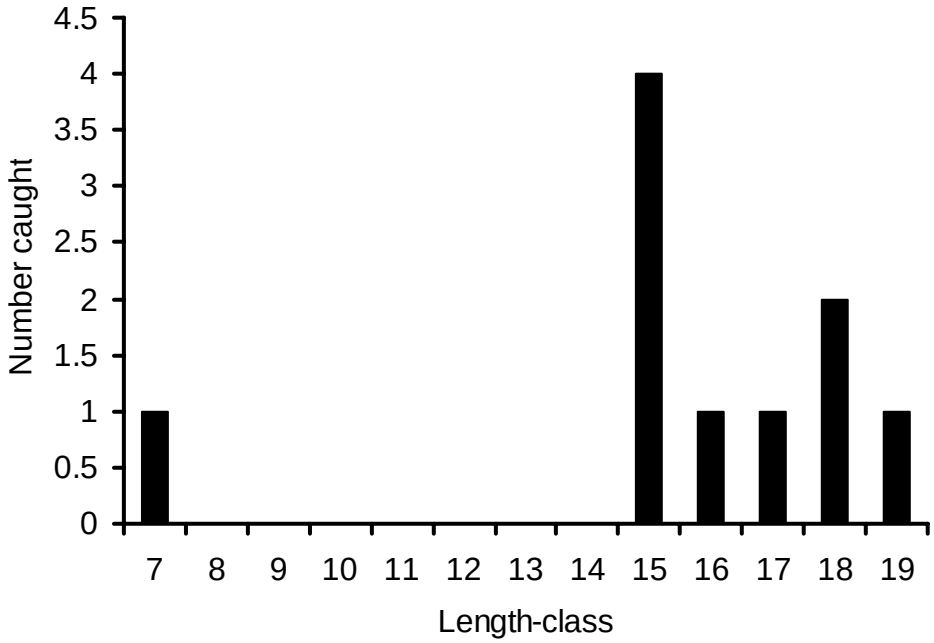

Figure 14. Number of northern pike sampled per 1.0-inch length-class from Berry Lake, Oconto County Wisconsin during 2003. Six mini-fyke nets were set on 13 August and lifted on 14 August, and the entire shoreline was electrofished on 7 October.

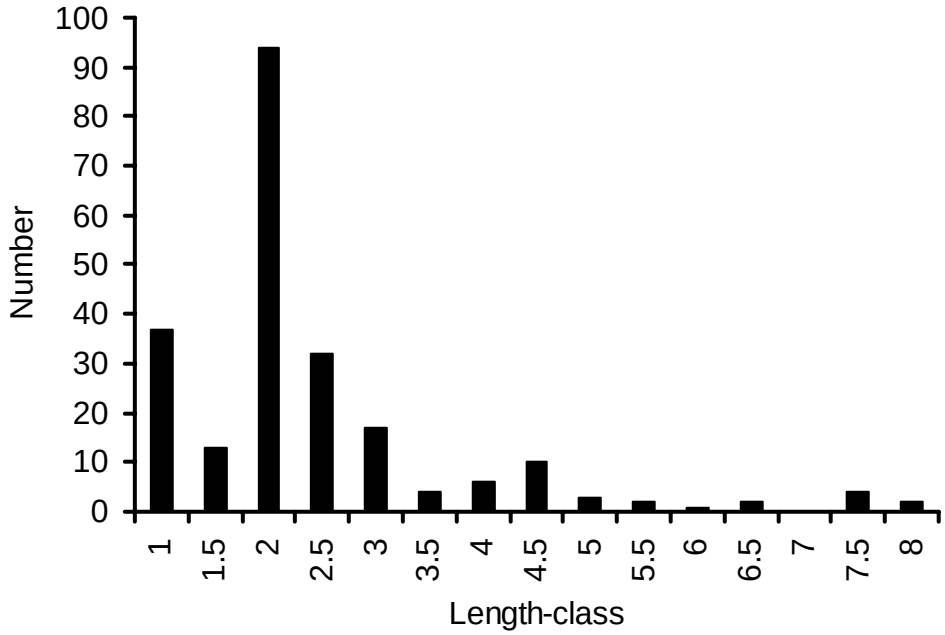

Figure 15. Number of pumpkinseed sampled per 0.5-inch length-class from Berry Lake, Oconto County Wisconsin during 2003. Six mini-fyke nets were set on 13 August and lifted on 14 August, and the entire shoreline was electrofished on 7 October.

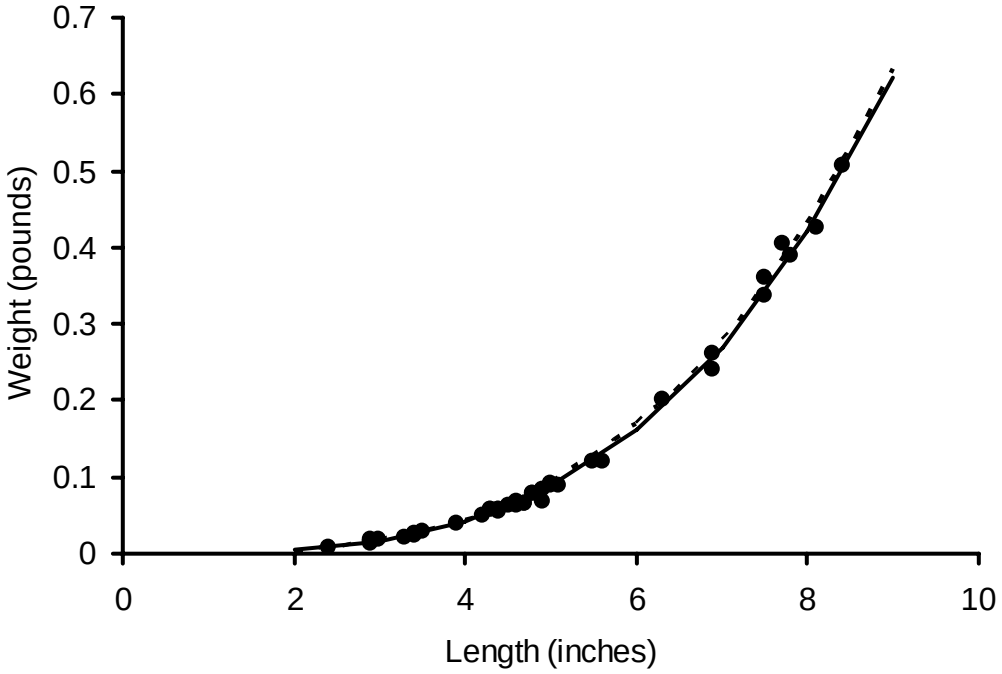

Figure 16. Weight-length data from pumpkinseed sampled from Berry Lake, Oconto County Wisconsin during 2003. The curvilinear relationship for the sample (solid line) and the relationship proposed by Liao et al. (dashed line; 1995) for the species are given.

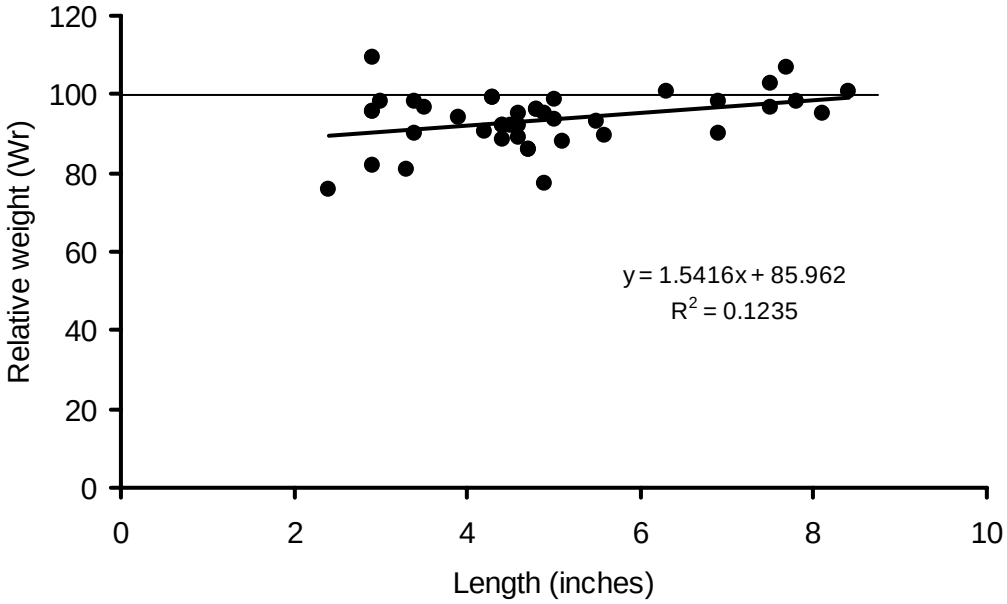

Figure 17. Relative weight W_r plotted versus length for pumpkinseed sampled from Berry Lake, Oconto County Wisconsin during 2003. The regression line and equation, coefficient of determination R^2, and a reference line at $W_r = 100$ are given.